

130D-1

DRAFTING AND SKETCHING

AG 130-D

UNIT OBJECTIVE

After completion of this unit, students will understand basic drawing and sketching skills and be able to use the proper tools for drawing and sketching. This knowledge will be demonstrated by completion of assignment sheets and a unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Identify the different types of lines used in a drawing or layout.
2. Identify the three types of drawings (orthographic, isometric, and oblique).
3. Use a ruler or architect's scale in drafting.
4. Interpret a working drawing.
5. Interpret three-view (orthographic) drawings.
6. Sketch an object, using paper and pencil.
7. Plan and lay out a construction project.
8. Calculate construction costs for a given project.
9. Assemble and finish a project.

PREPARING A WORKING DRAWING

A. Sketches and Working Drawings

1. Sketches are freehand drawings of an object for a project done in order to get the idea down on paper.
 - a. Sketches are not usually drawn to scale.
 - b. Neatly drawn sketches with fairly accurate dimensions are usually sufficient for simple projects.
 - c. Sketches of larger and more complicated projects can serve as the basis for accurate working drawings.
2. Working drawings are complete drawings done in universal graphic language so that the object depicted can be constructed from the drawing alone without additional information.
 - a. Dimensions - Working drawings use lines scaled to the dimensions of the actual objects.
 - b. Views - Working drawings show specific views of an object with enough detail to enable project construction.
 - 1) Most working drawings show three separate sides of an object from three flat, head-on views.
 - 2) Pictorial drawings show three sides of an object together in one view.

B. Types of Working Drawings

1. Orthographic Drawings

- a. They show a flat, head-on view of every side that differs in size and shape.
- b. They may illustrate six views of the object: top, bottom, front, back, right side, and left side (the ends).
- c. They usually use only three views: top, front, and end.

2. Pictorial Drawings

a. Isometric Drawings

- 1) Isometric drawings are based on three lines or axes: one vertical axis with two others at 60 degrees to the vertical.

- 2) Such drawings can show the true dimensions of an object's top, side, and end views.
- 3) The line angles of isometric drawings are not accurate, but are nevertheless used to give the object a three dimensional effect.

b. Oblique Drawings

- 1) Oblique drawings are based on three lines or axes similar to isometric drawings, except that one axis is horizontal, one vertical, and the third is at a convenient angle (typically 30 degrees to 45 degrees) to the horizontal.
- 2) Like isometric drawings, oblique drawings can depict the true dimensions of an object's top, side, and end.
- 3) The front of an oblique drawing always shows the true shape of that side of the object from a head-on view.
- 4) If the object being drawn has a side with curved or irregular lines, this side is used for the front.

SAFETY IN SKETCHING, DRAWING, AND PLAN READING

Some pieces of drawing equipment have sharp points; therefore, when using these drawing instruments, you should exercise care to prevent injury to yourself and/or others.

Safety Practices:

1. Keep sharp-pointed drawing instruments stored in their case to prevent injury to yourself and/or others.
2. When using drawing instruments, lay them in a safe place to prevent them from falling.
3. To prevent drawing instruments from falling, fasten the drawing tabletop securely before you start to draw.
4. Never play with sharp-pointed drawing instruments.

C. Constructing Working Drawings

1. Drawing to Scale

- a. Scale drawing permits the size of the object to be reduced proportionally in order for it to be drawn on the size of paper chosen.
- b. Common scales of a drawing may be 1/8," 1/4," 3/4," 1," and 3," to represent one foot. For example, 1/8 inch = 1 foot.

130D-4

- c. An architect's scale is the most common type of scale used for drawing agricultural projects.
 - 1) Its main divisions at the end of the scale, which are in inches or fractions of an inch, represent one foot.
 - 2) The divisions are subdivided even smaller to represent inches and fractions of an inch.
 - 3) An architect's triangular scale has six faces with a different scale on each end of each face.
- d. Use of engineer's paper (graph paper) permits drawing to scale without an architect's scale. It is cross-ruled paper with 4, 8, or 12 divisions to the inch. Simply count the number of divisions in order to draw a line to scale.

2. Sheet Layout (Example, Figure 1 on page 130D-10)

- a. Attach a sheet of paper to the drawing board with tape.
 - 1) If a T square and triangles will be used as drawing aids, use the T square to align the paper with the left edge of the drawing board.
 - 2) If a T square is not available, tracing paper or vellum may be attached with engineer's paper under it to serve as a drawing aid.
- b. Draw border lines $\frac{1}{2}$ inch from the paper's edge, $\frac{3}{4}$ inch from the bottom.
- c. Make a title block at the bottom of the paper which includes the following information about the drawing:
 - 1) The name of the person doing the drawing.
 - 2) The date of the drawing.
 - 3) The title of the drawing.
 - 4) The scale of the drawing.

3. Types of Lines Used in Drawings (Page 130D-9)

- a. Border line: a heavy, solid line drawn parallel to the edge of the drawing paper.
- b. Object line: a solid line representing the visible edges and form of an object.
- c. Hidden line: a series of dashes which indicate the presence of hidden edges.

- d. Extension line: a solid line indicating the exact area specified by a dimension.
- e. Dimension line: a solid line with arrowheads at both ends to indicate the length, width, or height of an object.
- f. Center line: a long-short-long line used to depict the center of a round object.
- g. Leader line: a solid line with an arrow pointing from an explanatory note to a specific feature of an object.
- h. Break line: a solid, zigzag line which indicates that part of the object being drawn is not fully illustrated or has been left out.

4. Developing the Views

- a. Choose an appropriate scale which will allow all views to fit within the border lines.
- b. Locate and mark off the spaces for the various views.
- c. Establish the main lines of the drawing, then add the minor ones.
- d. Develop all the views together. In a three-view, orthographic drawing, project from the front view to the top and end views with the T square and triangles.
 - 1) Use the T-square against only the left edge of the board for drawing horizontal lines, since the board may not be perfectly square.
 - 2) Use a right-angle triangle with the T-square to draw vertical lines.
- e. Finally, add the dimension lines and notes.

ACTIVITY:

1. Make a freehand sketch of a simple shop project. Engineer's paper can be used.
2. Develop an orthographic (3-D) drawing from the sketch of the project.

PROJECT PLANNING & CONSTRUCTION

A. Project Planning Considerations

1. Will the project be subject to loads or weights such that strength considerations must be taken into account?
 - a. Strength is important when planning a ladder or ramp, but it is not as critical a factor when planning a decorative lamp stand.
2. Are suitable materials, tools, and fasteners readily available?
 - a. If building a project that needs to be arc welded, is the appropriate type (AC, DC, MIG, TIG) and size of welder available along with the correct size and type of welding rod?
3. Is there a similar part or item commercially available which would eliminate the need to "reinvent the wheel."
 - a. For example, if planning to build an engine stand, check commercially available models to get ideas regarding design, size, and types of materials used, as well as joint types.
4. Use standard size, commercially available parts and components to hold down expense and excessive fabrication time and costs.
 - a. It will cost more and require more fabrication time to specify 1/8" X 1-1/16" strip steel (NOT commercially available) rather than 1/8" X 1" strip steel which is commercially available.
5. Consider set-up and jiggling techniques to eliminate "impossible" or extremely difficult fabrication and assembly.
 - a. When sketching or laying out plans, consider what the sequence of procedures should be in order to complete all the steps in the simplest and most efficient way.
6. When appearance is not a consideration, use less expensive materials.
 - a. Use hot rolled steel in place of cold rolled steel because the cost of hot rolled steel is less and the strength is the same even though the appearance is slightly less shiny.
 - b. Use economical grades of lumber for general utility and construction projects.

B. Interpreting Working Plans

1. Cutting List

- a. A cutting list itemizes the various dimensions of materials (wood, metal, etc.) that must be cut before being assembled.
- b. This tabular form includes the name of the project part, the number of pieces, the dimensions, and the type of material.
- c. This list serves as a checklist of project parts required for assembly and speeds up the construction process by alerting the builder to set up cutting jigs for project parts having the same dimensions.
- d. If a plan has no dimensions specified, but is drawn to scale, use an architect's scale to determine the dimensions required.

2. Bill of Materials (for more information look at Curriculum Section 130-I)

- a. A bill of materials is a list of all the materials needed for a project with the total cost calculated.
- b. This tabular form includes the number of pieces, the dimensions, a description of the items, the cost per unit, and the total cost.
- c. It is preferable to order standard stock sizes that will provide the desired materials with the least possible waste.
- d. List similar materials together and in the order they will be used.

C. Project Layout & Construction

1. Study the working drawing to understand which parts must be assembled first and in what sequence.
2. Construct jigs to speed up the assembly of duplicate parts (such as trusses).

ACTIVITY:

1. Have student draw the project on page 130D-10.
2. Calculate the construction cost of a project by making a bill of materials from a working drawing. A bill of materials form may be obtained from Section 130-I of the agricultural mechanics curriculum
3. Complete a cutting list from a working drawing of a project.
4. Use the drawing provided (130D-10) to construct a flywheel puller. Hole sizes and spacing will be determined by the flywheel and shaft, spacing should be equal.
5. Lay out and assemble a simple project. This may be coordinated with the unit on woodworking, welding, plumbing, or metalworking.

Special Material and Equipment:

A working drawing for the project to be constructed and the tools and materials required. Architect's scale or ruler, pencils, paper, drawing board, T square, 45 degree triangle (8" long sides), 30 degree X 60 degree triangle (10" side), cross-ruled paper, tracing vellum

References:

Burke, Stanley R., & Wakeman, T. J. (1990). MODERN AGRICULTURAL MECHANICS (2nd ed.). Danville, IL: Interstate Publishers.

Cooper, Elmer L. (1987). AGRICULTURAL MECHANICS: FUNDAMENTALS AND APPLICATIONS. Albany, NY: Delmar Publishers.

Jones, M. M. (1955). SHOPWORK ON THE FARM (2nd ed.). New York: McGraw-Hill.


Spencer, H. C., & Dygdon, J. T. (1980). BASIC TECHNICAL DRAWING. New York: Macmillan.


Resources:

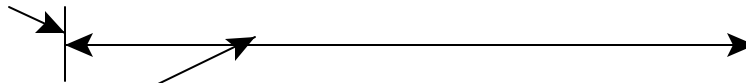
Bear, W. F., Hamilton, W. H., & Mann, A. (1974). PLANNING PROJECT CONSTRUCTION. Available from Hobar Publications, 1234 Tiller Lane, St. Paul, MN 55112, (612) 633-3170

BASIC LINES USED IN DRAWING AND SKETCHING

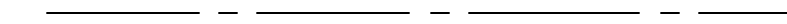
Border Line 


Object Line 

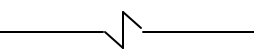
Hidden Line 

Extension Line 

Dimension Line 

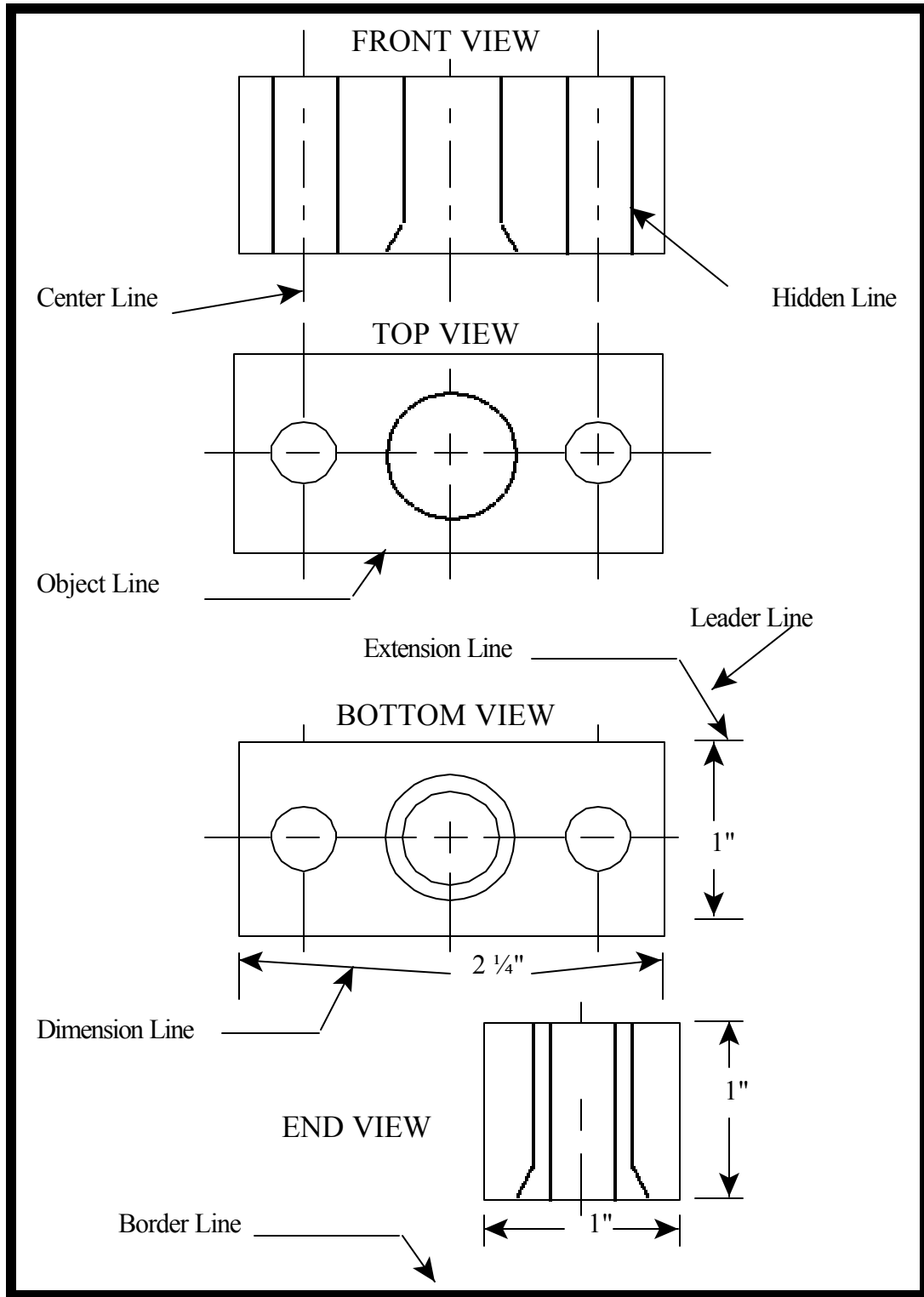
Center Line 

Leader Line 

Break Line 

130D-10

FLYWHEEL PULLER



DRAFTING WORKSHEET

Identify and name the following Views and Lines

1. View 1 _____ View 2 _____ View 3 _____

2. Line 1 _____

3. Line 2 _____

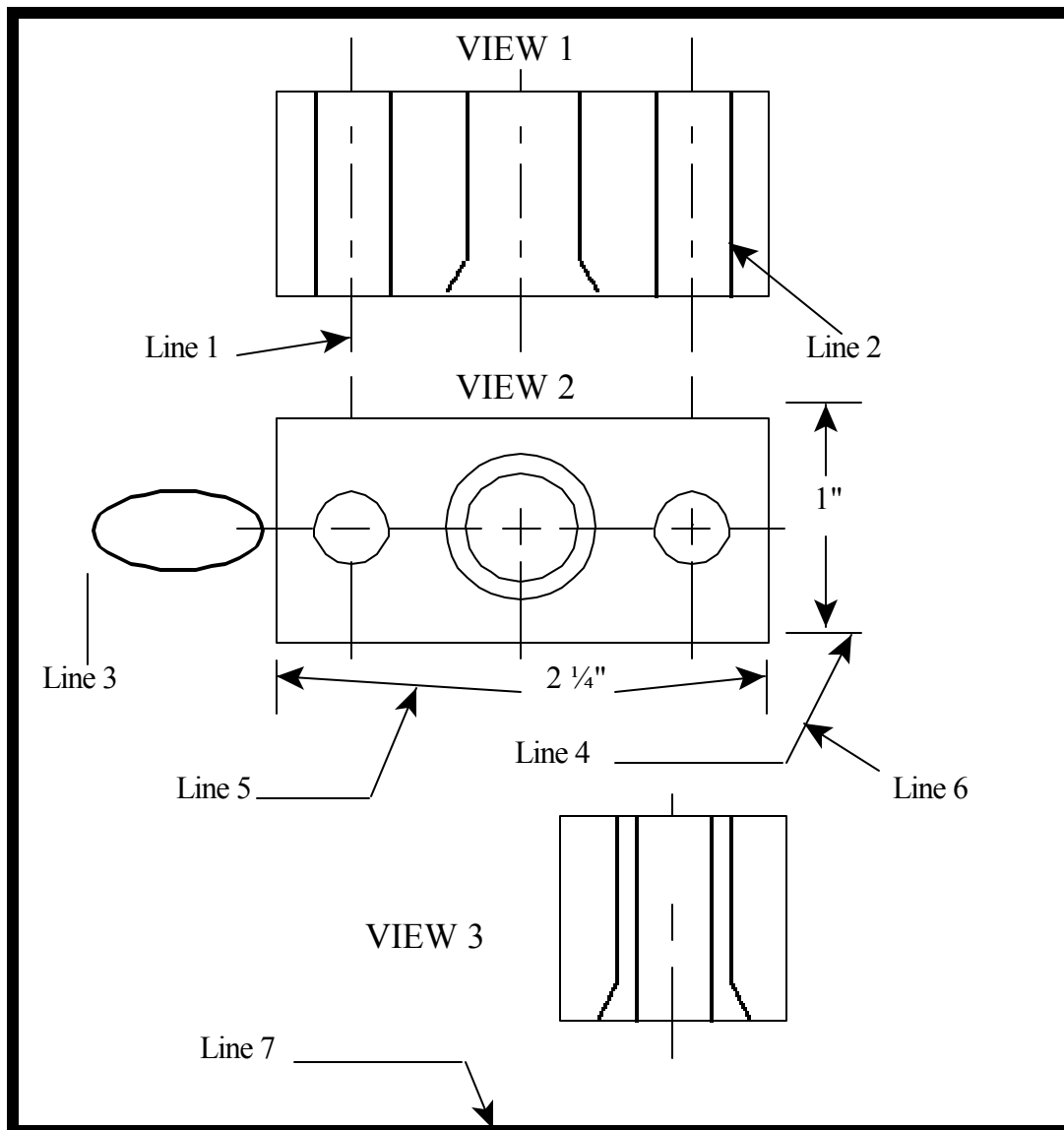
4. Line 3 _____

5. Line 4 _____

6. Line 5 _____

7. Line 6 _____

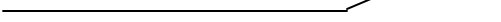




8. Line 7 _____



Name _____
Date _____

DRAFTING, EXAM

Answer the following questions 1 – 5, matching.

- | | |
|----------------------|---|
| 1. Border Line _____ | A.  |
| 2. Leader Line _____ | B.  |
| 3. Center Line _____ | C.  |
| 4. Hidden Line _____ | D.  |
| 5. Object Line _____ | E.  |

Fill in the Blanks and Short Answer

6. Name the three views on orthographic drawings.

7. _____, _____, _____.

8. What is a working drawing?

9. Name one safety practice used in making a drawing.

10. What does the Broken Line indicate? 

11. Name three items you will find in a title block.

12. _____, _____, _____.

13. _____, _____.

14. What drawing instrument is used to make horizontal lines.

15. What drawing instruments are used to make vertical lines?

Exam, Answer Sheet

1. D
2. A
3. E
4. B
5. C

6. Front, Side, End
7. Sketches are freehand drawings of an object for a project done in order to get an idea down on paper.
8. Working drawing are complete drawings done in universal graphic language so that the object depicted can be constructed from the drawing alone with out additional information.
9. Name one of the four. 1, Store sharp-pointed drawing instruments stored in their case. 2, Place drawing instruments in a safe place to prevent falling. 3, Fasten the drawing tabletop securely before you start to draw. 4, No playing with sharp-pointed drawing instruments.
10. Indicates that part of the object being drawn is not fully illustrated or has been left out.
11. Name of the person who doing the drawing, the date, and title of the drawing.
12. Name two of the five. Strength, Suitable Materials, Don't reinvent the wheel, Use standard sizes, Sequence of procedures.
13. Ruler or architects scale
14. T-square
15. T-square and a 90* triangle

Worksheet, answers

1. 1, Side View 2, Bottom View 3, End View
2. Line 1 – Center Line
3. Line 2 – Hidden Line
4. Line 3 – Object Line
5. Line 4 – Extension Line
6. Line 5 – Dimension Line
7. Line 6 – Leader Line
8. Line 7 – Border Line